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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/622,405	08/17/2000	Alan H. Greenaway	124-786	6703

7590 04/18/2002

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EXAMINER

AMARI, ALESSANDRO V

ART UNIT	PAPER NUMBER
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2872

DATE MAILED: 04/18/2002

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/622,405

Applicant(s)

GREENAWAY ET AL.

Examiner

Alessandro V. Amari

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 04 February 2002.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-21 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-14, 20 and 21 is/are rejected.
- 7) ☒ Claim(s) 15-19 is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 17 August 2000 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☒ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____
- 4) ☐ Interview Summary (PTO-413) Paper No(s). _____
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other:

DETAILED ACTION

Claim Rejections - 35 USC § 102/103

1. Previous 35 U.S.C. 102/103 rejection in office action (Park et al., Park et al. in view of Lee, Park et al. in view of Torok) dated 10/04/01 is hereby rescinded including all allowable subject matter.

Claim Rejections - 35 USC § 102

2. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

3. Claims 1, 4, 5, 7, 11, 12 are rejected under 35 U.S.C. 102(b) as being anticipated by Kubo U.S. Patent 5,684,762.

In regard to claim 1, Kubo discloses (see Figure 2) an apparatus for producing simultaneously a plurality of spatially separated images from an object field comprising an optical system (26, 28) arranged to produce an image associated with a first focus condition; a diffraction grating (27) arranged to produce, in concert with the optical system, images associated with each diffraction order as shown in Figures 2 and 5 and means for detecting the images (29), wherein the optical system, diffraction grating and detecting means are located on an optical axis ("O" as shown in Figure 2) and the diffraction grating is located in a suitable grating plane (as shown in Figure 2) and the diffraction grating is distorted according to a quadratic function as described in column 4, lines 55-63 so as to cause the images to be formed under various focus conditions

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and said images spatially separated in a direction having a non-zero component perpendicular to the optical axis as is shown in the right side of Figure 2.

In regard to claim 4, Kubo discloses that the origin of the distortion function of the diffraction grating is displaced from the optical axis as described in column 4, lines 39-63 and as shown in Figure 11.

In regard to claim 5, Kubo discloses the origin of the quadratic distortion function is displaced to cause alignment along the optical axis of the images associated with each diffraction order as described in column 4, lines 64-67 and column 5, lines 1-3.

In regard to claim 7, Kubo discloses that the diffraction grating is any one of an amplitude-only diffraction grating, a phase only diffraction grating or a phase and amplitude diffraction grating as described in column 4, lines 28-38.

In regard to claim 11, Kubo discloses that the diffraction grating is a reflective grating or a transmissive grating as described in column 4, lines 28-38 and as shown in Figure 2.

In regard to claim 12, Kubo discloses the grating is any of a two-level (binary) structure, a multi-level (digitised) structure or a continuous-level (analogue) structure as described in column 4, lines 38-54.

Regarding claim 20, Kubo discloses a wavefront analyzer including an apparatus for producing simultaneously a plurality of spatially separated images from an object field as described in column 2, lines 7-29 and as shown in Figure 2.

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Regarding claim 21, Kubo discloses a passage ranging device including an apparatus for producing simultaneously a plurality of spatially separated images from an object field as described in column 2, lines 7-29 and as shown in Figure 2.

4. Claims 13 and 14 are rejected under 35 U.S.C. 102(b) as being anticipated by Park et al. U.S. Patent 5,526,336.

In regard to claim 13, Park et al. discloses (see Figure 7) an apparatus for producing simultaneously a plurality of spatially separated images from an object field comprising, an optical system (9A, 21, 3, 5) arranged to produce an image associated with a first focus condition; a diffraction grating (4') arranged to produce, in concert with the optical system, images associated with each diffraction order and means for detecting the images (11A), wherein the optical system, diffraction grating and detecting means are located on an optical axis as shown in Figure 7 and the diffraction grating is located in a suitable grating plane and is distorted substantially according to a quadratic function so as to cause images to be formed under various focus conditions and adapted for forming images on a plurality of image planes (7, 8), from a single object plane as described in column 4, lines 10-25 and as shown in Figure 5.

Regarding claim 14, Park et al. discloses that the object plane contains a source of illumination (1) which is used to illuminate the image planes as described in column 1, lines 21-22.

Claim Rejections - 35 USC § 103

5. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

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(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

6. Claims 2, 3 and 6 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kubo U.S. Patent 5,684,762 in view of Lee U.S. Patent 5,721,629.

In regards to claims 2 and 3, Kubo teaches the invention as set forth above but does not teach that the function according to which the grating is distorted includes further terms for producing different amounts of spherical aberration in the images associated with each diffraction order nor does Kubo teach that the spherical aberration of images associated with each diffraction order is arranged to correct for spherical aberration associated with the different depths of substantially parallel planes in object or image space. Lee teaches that the function according to which the grating is distorted includes further terms for producing different amounts of spherical aberration in the images associated with each diffraction order as described in column 3, lines 35-67. Lee also teaches that the spherical aberration of images associated with each diffraction order is arranged to correct for spherical aberration associated with the different depths of substantially parallel planes in object or image space as described in column 3, lines 35-52. It would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the grating of Kubo to correct for spherical aberration as taught by Lee in order to compensate for the spherical aberration caused by the different thicknesses of the optical disk media.

In regard to claim 6, Kubo teaches the invention as set forth above but does not teach that the diffraction grating comprises a set of two or more diffraction gratings

designed such that the various diffraction orders are spatially separated. Lee does teach (see Figures 7A, 7B, 7C) that the diffraction grating comprises a set of two or more diffraction gratings (27a, 28a) designed such that the various diffraction orders are spatially separated as described in column 3, lines 35-50. It would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the grating of Kubo to incorporate the features of the grating as taught by Lee so that the grating exhibits low aberration.

7. Claim 10 is rejected under 35 U.S.C. 103(a) as being unpatentable over Kubo U.S. Patent 5,684,762 in view of Torok U.S. Patent 3,861,784.

In regard to claim 10, Kubo teaches the invention as set forth above but does not teach that the diffraction grating is a programmable grating. Torok teaches a diffraction grating that is programmable. It would have been obvious to one having ordinary skill in the art at the time the invention was made to utilize the programmable grating as taught by Torok in the invention of Kubo in order to provide selectivity of foci for different diffraction orders due to variation in layer thickness of the optical media.

8. Claims 8 and 9 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kubo U.S. Patent 5,684,762 in view of Katayama et al. U.S. Patent 5,453,963.

Regarding claim 8, Kubo teaches the invention as set forth above but does not disclose that the diffraction grating is polarization sensitive. Katayama et al. does disclose that the diffraction grating is polarization sensitive as described in column 2, lines 9-13 and column 5, lines 14-17.

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In regard to claim 9, Kubo teaches (see Figure 2) an apparatus for producing simultaneously a plurality of spatially separated images from an object field comprising an optical system (26, 28) arranged to produce an image associated with a first focus condition; a diffraction grating (27) arranged to produce, in concert with the optical system, images associated with each diffraction order as shown in Figures 2 and 5 and means for detecting the images (29), wherein the optical system, diffraction grating and detecting means are located on an optical axis ("O" in Figure 2) and the diffraction grating is located in a suitable grating plane (as shown in Figure 2) and is distorted substantially according to a quadratic function as described in column 4, lines 55-63 so as to cause images to be formed under various focus conditions but does not teach that the diffraction grating comprises two gratings sensitive to different polarizations and arranged such that the diffraction orders produced by said gratings are spatially separated. [Katayama et al. does teach that the diffraction grating comprises two gratings sensitive to different polarizations and arranged such that the diffraction orders produced by said gratings are spatially separated as described in column 12, lines 9-13 and column 7, lines 49-65.] It would have been obvious to one having ordinary skill in the art at the time the invention was made to incorporate the diffraction gratings as taught by Katayama et al. in the apparatus of Kubo in order to eliminate the need for the polarizing prism in Kubo and therefore make the apparatus of Kubo more compact.

Allowable Subject Matter

9. Claims 15-19 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

10. Claim 15 is allowable over the prior art for at least the reason that the prior art fails to teach or reasonably suggest, "adapted for producing substantially in focus images in a common image plane, from a plurality of object planes" as set forth in the claimed combination.

Claim 19 is allowable over the prior art for at least the reason that the prior art fails to teach or reasonably suggest, "a dispersive system for introducing an offset to an input beam of radiation, said offset being perpendicular to the optical axis and proportional to the wavelength of the input radiation, whilst leaving the beams at each wavelength following parallel paths" as set forth in the claimed combination.

The prior art of record, Kubo and Park et al. teach an apparatus for producing simultaneously a plurality of spatially separated images from an object field and wherein said images are spatially separated in a direction having a non-zero component perpendicular to the optical axis. Park et al. teaches an apparatus for producing simultaneously a plurality of spatially separated images from an object field and wherein said images are spatially separated. However, neither Kubo nor Park et al. teaches that the apparatus is adapted for producing substantially in focus images in a common image plane from a plurality of object planes. In addition, Kubo teaches an apparatus for producing simultaneously a plurality of spatially separated images from an object

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field but does not teach a dispersive system for introducing an offset to an input beam of radiation, said offset being perpendicular to the optical axis and proportional to the wavelength of the input radiation, whilst leaving the beams at each wavelength following parallel paths and no motivation or teaching is present to modify this difference as derived.

11. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Alessandro V. Amari whose telephone number is (703) 306-0533. The examiner can normally be reached on Monday-Friday 8:00 AM to 5:30 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Cassandra Spyrou can be reached on (703) 308-1687. The fax phone numbers for the organization where this application or proceeding is assigned are (703) 872-9318 for regular communications and (703) 872-9319 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 308-0956.

ava (JW)
April 16, 2002



Cassandra Spyrou
Supervisory Patent Examiner
Technology Center 2800